



Standard Terminology Relating to Radiation Measurements and Dosimetry¹

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ε¹ NOTE—Equation 2 was editorially corrected in April 1999.

INTRODUCTION

This terminology generally covers terms that apply to radiation measurements and dosimetry associated with energy deposition and radiation effects, or damage, in materials caused by interactions by high-energy radiation fields. The common radiation fields considered are X-rays, gamma rays, electrons, alpha particles, neutrons, and mixtures of these fields. This treatment is not intended to be exhaustive but reflects special and common terms used in technology and applications of interest to Committee E-10, as for example, in areas of radiation effects on components of nuclear power reactors, radiation hardness testing of electronics, and radiation processing of materials.

This terminology uses recommended definitions and concepts of quantities, with units, for radiation measurements as contained in the International Commission on Radiation Units and Measurements (ICRU) Report 33 on “Radiation Quantities and Units,” April 15, 1980.² Those terms that are defined essentially according to the terminology of ICRU Report 33 will be followed by ICRU in parentheses. It should also be noted that the units for quantities used are the latest adopted according to the International System of Units (SI).

absorbed dose (D)—Quantity of ionizing radiation energy imparted per unit mass of a specified material. The SI unit of absorbed dose is the gray (Gy), where 1 gray is equivalent to the absorption of 1 joule per kilogram of the specified material (1 Gy = 1 J/kg). The mathematical relationship is the quotient of $d\bar{\epsilon}$ by dm , where $d\bar{\epsilon}$ is the mean incremental energy imparted by ionizing radiation to matter of incremental mass dm (see ICRU 33).

$$D = d\bar{\epsilon} / dm \quad (1)$$

DISCUSSION—The discontinued unit for absorbed dose is the rad (1 rad = 100 erg/g = 0.01 Gy). Absorbed dose is sometimes referred to simply as dose. For a photon source under conditions of charged particle equilibrium, the absorbed dose, D , may be expressed as follows:

$$D = \Phi \cdot E \cdot \mu_{en}/\rho, \quad (2)$$

where:

Φ = **particle fluence** (particles/m²),
 E = **energy of the ionizing radiation** (J), and

μ_{en}/ρ = **mass energy absorption coefficient** (m²/kg).

If bremsstrahlung production within the specified material is negligible, the mass energy absorption coefficient (μ_{en}/ρ) is equal to the mass energy transfer coefficient (μ_{tr}/ρ), and absorbed dose is equal to kerma if, in addition, charged particle equilibrium exists.

absorbed dose rate, $\dot{D}$ —the absorbed dose in a material per incremental time interval, that is, the quotient of dD by dt (see ICRU Report 33).

$$\dot{D} = dD/dt \quad (3)$$

SI unit: Gy·s⁻¹.

DISCUSSION—The absorbed-dose rate is often specified in terms of the average value of D over longer time intervals, for example, in units of Gy·min⁻¹ or Gy·h⁻¹.

accuracy—the closeness of agreement between a measurement result and an accepted reference value (see Terminology E 456).

activation cross section—the cross section for processes in which the product nucleus is radioactive (see **cross section**).

activity, A —of an amount of radioactive nuclide in a particular energy state at a given time, the quotient of dN by dt , where dN is the expectation value of the number of spontaneous nuclear transitions from that energy state in the time interval dt (ICRU).

¹ This terminology is under the jurisdiction of ASTM Committee E-10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.93 on Editorial.

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² Available from International Commission on Radiation Units and Measurements (ICRU), 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814.

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